



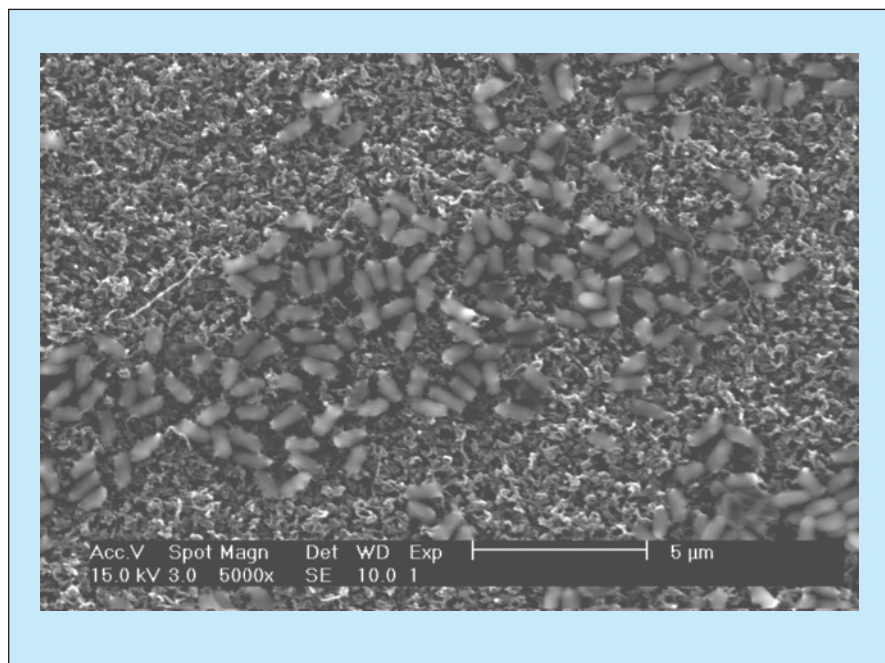
## Nanocarpet for Trapping Microscopic Particles

**Properties of nanocarpet can be tailored for selective trapping.**

*NASA's Jet Propulsion Laboratory, Pasadena, California*

Nanocarpet — that is, carpet of carbon nanotubes — are undergoing development as means of trapping microscopic particles for scientific analysis. Examples of such particles include inorganic particles, pollen, bacteria, and spores. Nanocarpet can be characterized as scaled-down versions of ordinary

macroscopic floor carpets, which trap dust and other particulate matter, albeit not purposefully. Nanocarpet can also be characterized as mimicking both the structure and the particle-trapping behavior of ciliated lung epithelia, the carbon nanotubes being analogous to cilia (see figure).



**Microscopic Particles** (*Bacillus pumilis* spores) were trapped on a nanocarpet by immersing the nanocarpet in a spore-containing solution, then drying the nanocarpet.

Carbon nanotubes can easily be chemically functionalized for selective trapping of specific particles of interest. One could, alternatively, use such other three-dimensionally-structured materials as aerogels and activated carbon for the purposeful trapping of microscopic particles. However, nanocarpet offer important advantages over these alternative materials:

- Nanocarpet are amenable to noninvasive probing by optical means; and
- Nanocarpet offer greater surface-to-volume ratios.

*This work was done by Flavio Noca, Fei Chen, Brian Hunt, Michael Bronikowski, Michael Hoenk, Robert Kowalczyk, and Daniel Choi of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

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## Precious-Metal Salt Coatings for Detecting Hydrazines

**Colors change upon exposure to hydrazines and perhaps other hazardous gases.**

*Lyndon B. Johnson Space Center, Houston, Texas*

Substrates coated with a precious-metal salt  $\text{KAuCl}_4$  have been found to be useful for detecting hydrazine vapors in air at and above a concentration of the order of 0.01 parts per million (ppm). Upon exposure to air containing a sufficient amount of hydrazine for a sufficient time, the coating material undergoes a visible change in color. Although the color

change is only a qualitative indication, it can serve as an alarm of a hazardous concentration of hydrazine or as advice of the need for a quantitative measurement of concentration. Detection of hydrazine vapors by this technique costs much less and takes less time than does laboratory analysis of sorbent tubes using high-performance liquid chromatography, which is the tech-

nique used heretofore to detect hydrazines at concentrations down to 0.01 ppm.

A substrate for use in this technique should be made of a chemically inert material (e.g., fiberglass filter paper). The substrate is uniformly coated with 1 to 10 weight percent of the precious-metal salt in a solvent (e.g., dilute HCl) that does alter the physical characteris-